

Innovation case studies

Paris Air Show

JUNE 2019

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ENSO

(Expleo Nanosat for Solar-irradiance
Observations)

R&D project in partnership with the University Space Center of
Montpellier (CSUM)

The context

The commercialisation of space has expanded the market and opened opportunities for companies that can harness new technologies for satellites, nanosatellites and ground stations. Nanosatellites offer a new way to explore space due to their cost-effectiveness and shorter production deadlines.

The project

Expleo is leveraging its proven expertise in both system and space engineering with ENSO, a nanosatellite R&D platform, that aims to characterise the ionosphere, measure solar activity and its impact on earth. ENSO allows easy access to the new space, with reduced costs due to the minimization of technologies, and faster deployment.

Our partner

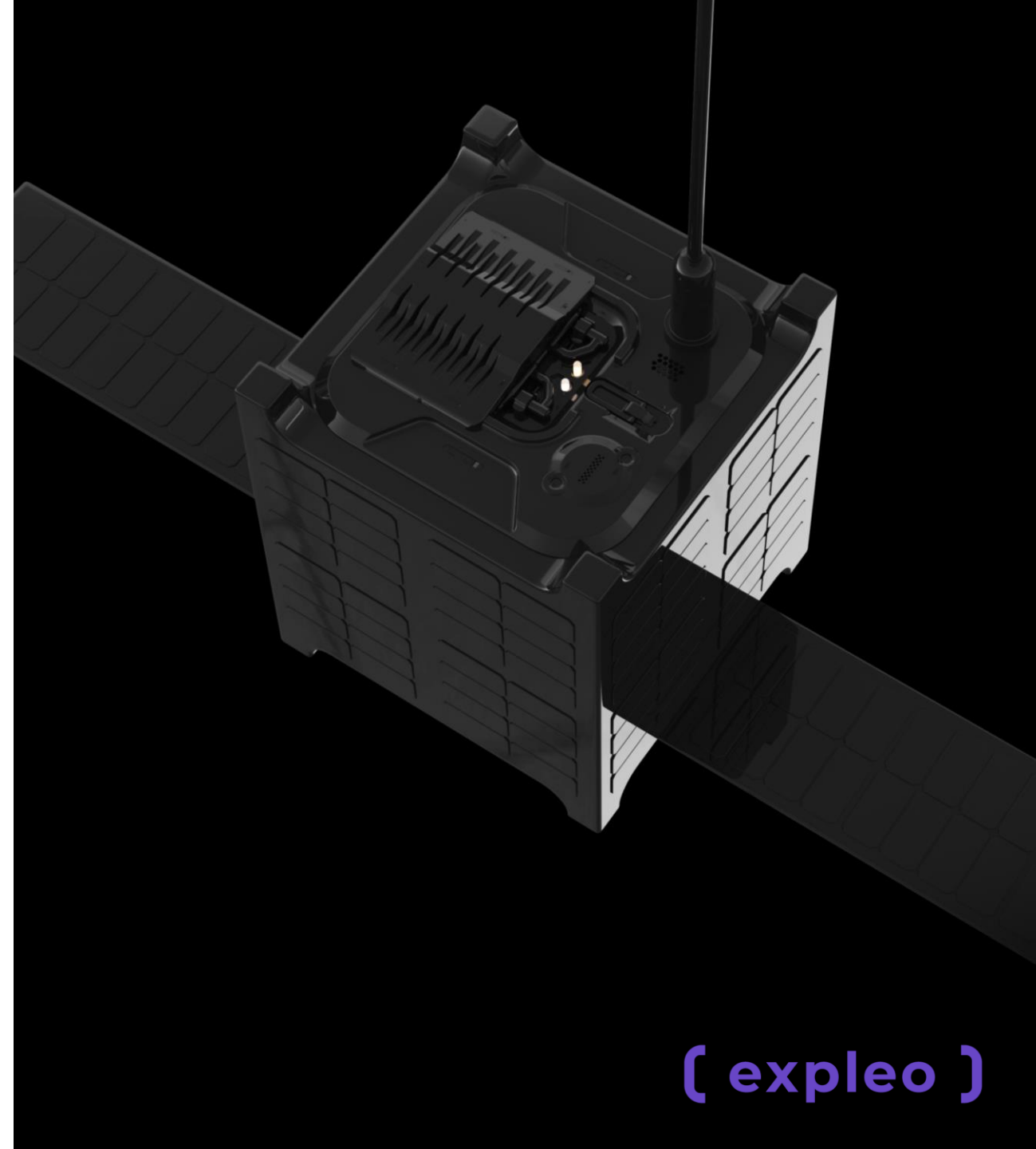
The CSUM provides the nanosatellite building platform, offering its field experience and expertise to shape the infrastructure and resources that are necessary for the launch of the nanosatellite. The Expleo team is in charge of embedding the software that captures data from space and also developing the communication instruments in the ground control station that will facilitate digital signal processing.

Expleo's expertise in action

- Systems engineering (embedded and imaging systems, measurement sensors)
- Space engineering (testbench architecture, software Defined Radios (SDR))
- Testing methods
- Test phases and AIT (Assembly, Integration and Test)

What's next?

Once the research phase is approved, Expleo and the CSUM will develop, integrate and validate the satellite before it enters the market.



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Bamco

(BAmboo long fibre reinforced
biobased Matrix Composites)

R&D project led by Expleo in association with 7 partners

The context

The EU's REACH regulation is revolutionising the aerospace market by banning certain chemical substances from use in the manufacturing process. Industries are encouraged to develop alternative methods that will produce materials with a reduced ecological impact.

The project

New bio-composites produced from long bamboo fibres can reduce aircraft weight and fuel consumption, guarantee resistance and vibration absorption, while saving costs. It is also a widespread crop that can be industrialised without harming natural resources.

The Bamco project, led by Expleo, aims to pre-industrialise bio-composites from bamboo fibres and bio-based resins to replace glass/phenolic composites used as cabin cladding panels.

Our partners

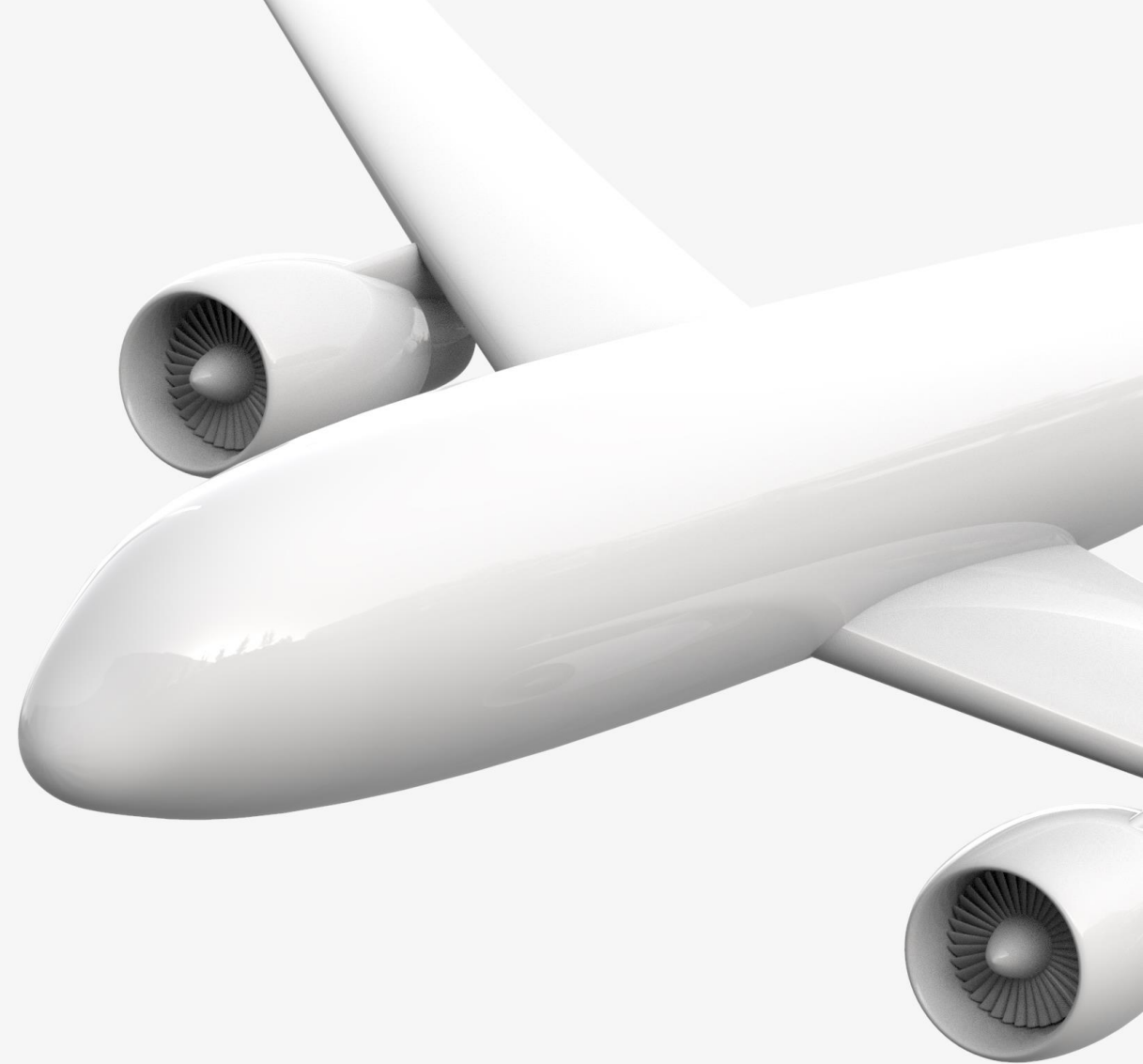
Expleo is associated with 7 key partners with complementary expertise: Arkema, Cirimat, Cobratex, Compositadour, Lisa Aeronautics, Mecano ID and Specific Polymers. The project has been certified by Aerospace Valley and subsidised by Occitania and Normandy regions and Bpifrance.

Expleo's expertise in action

- Material engineering expertise from research to industrialisation
- Design and implementation of prototype parts
- Testing according to aeronautical standards

What's next?

After three years of research, Expleo has started the pre-industrialisation stage with a view to manufacture prototype parts by 2021. In a cross-fertilisation approach, this innovation can be applied to other industries such as automotive, urban electric vehicles or sports materials to develop alternative sustainable materials for plastic composites.



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Co-drones

In-house R&D project

The context

The logistics market has been undergoing a revolution since the arrival of intelligent and autonomous systems. These solutions are also useful for quality inspection processes in different industries to automate certain tasks and facilitate the transmission of information.

The project

The aim of the project Co-drones is to launch a cooperative fleet of drones that can map areas, identify objects or people, and deliver loads. Designed to be autonomous, the drones can self-organise according to different parameters such as location.

This innovation is designed to deal with delivery issues. It can be extended to quality inspection in different industries, whether rail, nuclear power, aerospace or marine.

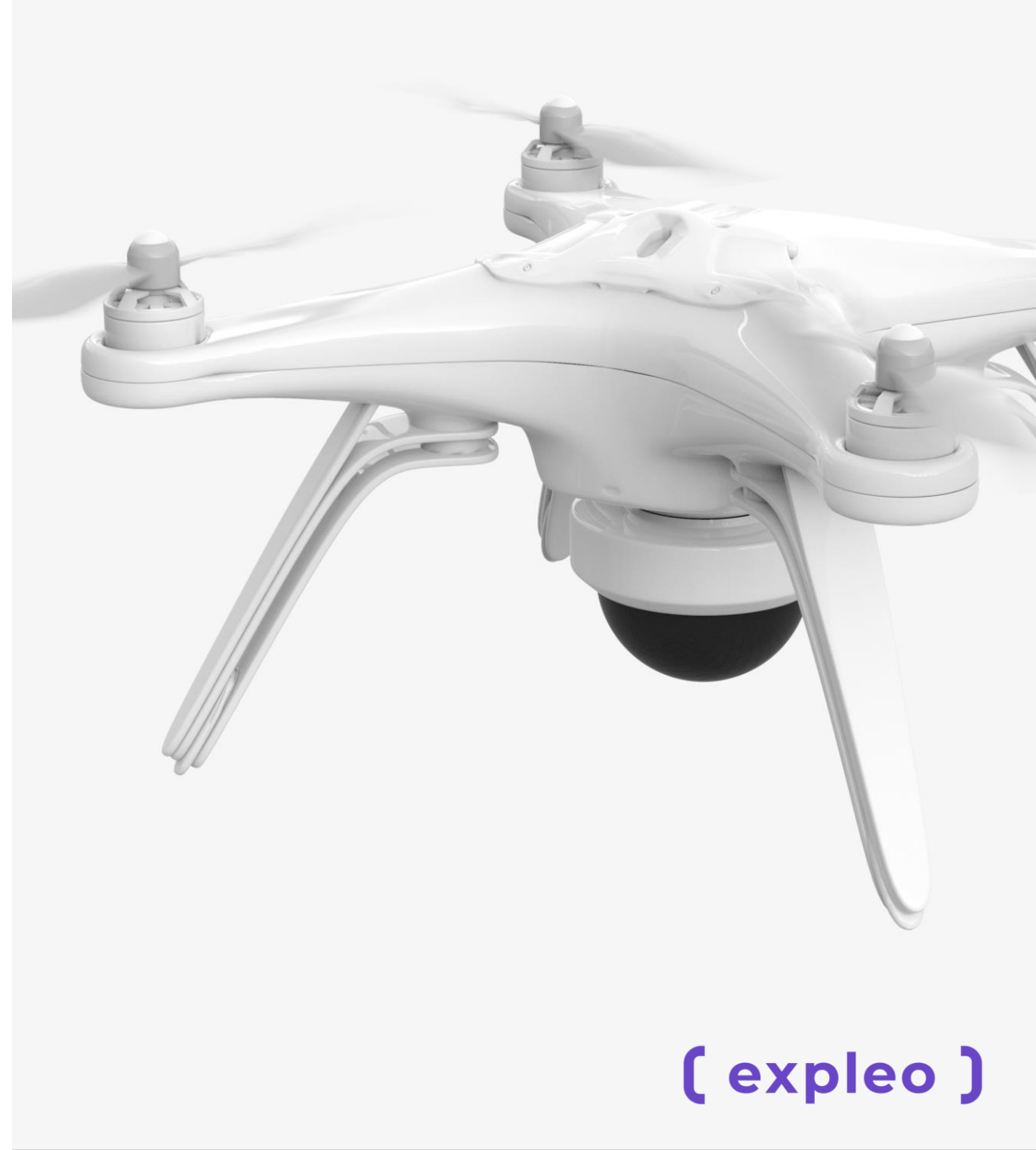
A fleet of drones, unlike a single drone, increases performance and productivity. It allows a better cost-saving policy thanks to its wider geographic coverage and longer range.

Expleo's expertise in action

- Autonomous systems
- System-to-system communication
- Indoor localisation
- Machine learning
- Image and video processing
- Mechanical engineering

What's next?

This solution of self-organisation of a system composed of several intelligent equipments can be extended to other applications besides drones (ex: robots, cameras, ...).



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ASM

R&D project developed for AIRBUS

The context

Players in the aerospace industry are constantly confronted with different sources of information when managing product implementation. The search and use of this data results in loss of time and productivity. The main barrier is the digitisation of data, which is key for product development.

The project

To address this issue and facilitate data transfer, Expleo has set up ASM - Aircraft Status Monitor - a web-based visual solution which creates a link between 3D models and engineering data. This software enables the selection and extraction of a certain number of engineering data within a 3D visual product. This visual project management solution enables to locate more easily the various types of documents related to the parts of a device or aircraft component, while limiting time loss throughout the product life cycle.

Expleo's expertise in action

- Product customisation
- Software and design engineering

What's next?

Anticipating future Product Data Management Systems, ASM is a typical example of short-term bottom-up implementation leading a long term transformation.



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ADFEM

Service offer implemented for MITAC

The context

The digitalisation of industrial processes and data makes it possible for manufacturers to evaluate the performance of a product over the long term. This also allows them to cross-reference product information in order to generate new and enhanced innovations. It is possible to perform simulation to anticipate certain difficulties and optimise manufacturing costs, product development time and data accuracy. By gathering design, stress, manufacturing and test expertise data, manufacturers can better secure the product design process. As part of the development of a new product, MITAC has identified a need for support on the simulation part of the product life cycle.

The project

ADFEM is a solution for the modeling and numerical simulation of structure calculation. Thanks to its extremely advanced calculation capabilities, ADFEM makes it possible to optimise the design of the parts of a structure while maintaining a guarantee of quality, control of costs and associated deadlines. ADFEM allows engineers to anticipate possible non-conformity by improving the design of the parts of a structure while taking into account many aspects and physics of the whole product lifecycle including manufacturing processes, tests and fatigue.

Expleo expertise put to work

- End to end structural simulation
- Hotspot mapping for FTV configuration
- Generation of certification files
- Correlation with test cell
- Digitalisation of products
- Configuration management

What's next?

ADFEM can be applied throughout any product lifecycle from development to in-service.

Its adaptability to any mechanical simulation such as cars and helicopters leads to further development, and opens new opportunities.



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ELSIO

Service offer developed by Expleo

The context

Businesses are always looking for optimisation throughout the product life cycle. Digital transformation within any industry is a major but necessary challenge to save time and money. Because today's organisations and data are siloed, it is fundamental to have a global approach to support this transformation. A consulting approach makes it possible to identify opportunities and put into practice the necessary means to deliver a better return on investment.

The project

Elsio is an integrated solution to life cycle cost optimisation. Expleo participates in empowering changes within the working processes and organisations to help realise the client's strategic vision. Expleo delivers solutions to improve the products and the profitability of the company by maximising time and cost efficiency across the whole business.

The offer is structured around 3 pillars: Innovate, Collaborate and Operate. These steps correspond to the product life cycle (design, manufacturing, service) in which we find the key tools to successfully transform it: data, knowledge, capability, process, people and smart KPI's.

Expleo's expertise in action

- Consultancy
- Engineering skills
- Digital know-how (systems, data science)
- Change management
- Assessment models
- Client-focused operating models

What's next?

Elsio is designed to be extended to different sectors such as automotive or transport. Learning from previous experiences with different companies and the challenges faced during the consultancy stage, Elsio will widen its set of tools and bring Big Data and AI into the offer.



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Cellular core tech.

R&D project developed for AIRBUS

The context

According to OEMs' new challenges concerning their wing structures, the need to boost efficiency, productivity and cost reduction is essential in processing methods. The management of non-conformance and the heavy weight of some parts can prove an important issue. It is a real challenge to integrate manufacturing of lightweight structure in a one-shot process in order to reduce costs and save production time.

The project

To help optimise the wing structure design and processing methods, Expleo has worked on a composite design, tooling and processing methods that uses sacrificial pressurised thermoplastic cores. This unique process allows clients to create complex composite structures in an integrated one-shot process. In partnership with Aerosud Technology solutions, Expleo has considerably reduced costs and time in the wing manufacturing process. This new opportunity allows clients to eliminate the need for secondary fasteners and vacuum bagging process. The design and prototyping can be done with a 3D printer.

Expleo's expertise in action

- Stress analysis and engineering
- Design analysis and engineering
- Partnership with Aerosud for manufacturing

What's next?

Cellular Core Technology can also be applied to the space and automotive industries as well as gas and oil sectors. The aim is to implement this concept with different type of materials and use robotic platforms for manufacturing.

An abstract, dark blue background featuring a glowing, wavy pattern of small white dots that resemble a cellular or honeycomb structure, curving upwards from the bottom left towards the top right.

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NG structure

R&D project developed for Flying Whales

The context

Faced with increasingly demanding weight saving objectives, the traditional aeronautical structures composed of beams and cables are being re-invented thanks to an optimisation of their stability and load paths.

Through applications such as next-generation cargo airships, space exploration robots, or intelligent structures allowing wing morphing; tensegrity principles demonstrate their efficiency in the design of high-performance structures.

In this context, the understanding and digital mastery of stability is at the forefront. Since 2018, Expleo has been developing a digital tool to help design structures that are at the edge of stability.

The project

As part of the Flying Whales project, Expleo has developed a fast numerical aiming at solving the stability issue commonly present in the typology of these structures which have a high number of links with variable degrees of freedom. Expleo automates the global analytical calculation of stability and the writing of the data set, in order to fluidify the calculation loops. This solution enables the optimised conception of structures capable of evolving over time.

Expleo's expertise in action

- Numerical simulation
- Digital twin
- 3D CAD printing
- Fast prototyping by additive manufacturing

What's next?

The success of the project will rely on the optimisation of the assembly and disassembly phases. The next step will consist in understanding each step of the material's life cycle, with the objective of better supporting the design of dynamic structures. Investigating the flexibility and distortion of these structures are also key objectives. NG Structure aims to support the development of exploration robots, wing morphing and all other intelligent structures in their transformation.



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FADEC

Device developed in-house by Expleo (Silver Atena)

The context

A FADEC (full authority digital engine control) enables comfortable engine handling, provides for efficient engine operation for a given condition and allows the engine manufacturer to program engine limitations and receive engine health and maintenance reports. New types of engines require modern and innovative control systems.

The project

Silver Atena's aircraft engine control unit family (FADEC) controls aircraft engines for general aviation. The redundant electronics monitor and control over 115 inputs and outputs (I/Os). The FADEC offers comprehensive engine monitoring and detects electrical and mechanical failures of the engine control system. The diagnostic capabilities which include lifetime monitoring and an intelligent fault management enable operation of the engine at the highest safety level. Performance and consumption optimisation as well as single lever power control are already implemented in the FADEC.

Expleo's expertise in action

- System design & architecture
- Functional safety
- Hardware / software engineering
- Manufacturing, test & verification
- Qualification & certification
- Production & series delivery

What's next?

Just as all types of aircraft engines are still being improved, so are FADECs. New components allow for smaller, lightweight units allowing more flexibility to eg. suit UAVs.



DMCU

Device developed in-house by Expleo (Silver Atena)

The context

Because of their quiet, environmentally friendly and cost-effective operation, electrically powered aircraft represents a forward-looking perspective for mobility. However, the success of the deployment depends significantly on the availability, reliability and integrity of key technologies to be developed. The motor and its controller are key items in this system because they not only have to work reliably but also as efficiently as possible.

The project

The Silver Atena DMCU is a compact, high performance motor controller for an electric propulsion system of an aircraft or rotorcraft. It is designed to control a duplex motor consisting of two independent motors mounted on the same drive shaft ensuring a maximum of safety. Depending on the operating requirements, the DMCU can provide the required power by any power distribution between the two motors to optimise the overall efficiency of the propulsion system.

Expleo's expertise in action

- System design & architecture
- Functional safety
- Hardware / software engineering
- Manufacturing, test & verification
- Qualification & certification
- Production & series delivery

What's next?

Silver Atena is capable of developing complete control units and can deliver a comprehensive range of items for electric aircrafts and rotorcrafts. As system provider we cover the entire development process and of course the entire product lifecycle. Silver Atena's power electronics modular system is independent from vertical markets. With well-proven modules, i.e. scalable power stages (half / full bridges, B6 bridges) it provides both rapid execution and low technical risk.



UNIVERSAL APC

Device developed in-house by Expleo (Silver Atena)

The context

Automated functions like autopilot or stability augmentation system are common in modern and complex aircraft. Most of the smaller general aviation aircraft don't have these systems usually due to its cost. But benefits are uncontroversial. Automated flight controls can make a long flight much easier for the pilot, who can focus on the overall status of the aircraft. A plane could even be controlled by ground control, enabling eg. unpiloted air taxis.

The project

The Silver Atena Universal APC (Avionics Platform Computer) is a powerful computer which allows for highly-automated control (Flight Control Computer, FCC) of both manned and unmanned small aircraft and helicopters.

The large number of different interfaces makes it possible to embed the APC in a variety of avionics architectures. The flat mechanical design of the APC also allows for easy and space-saving installation in the aircraft, while the side-mounted connectors support optimized cable routing.

Expleo's expertise in action

- System design & architecture
- Functional safety
- Hardware / software engineering
- Manufacturing, test & verification
- Qualification & certification
- Production & series delivery

What's next?

To improve its use, the Silver Atena teams are working on the design of the device to make it even more compact and adaptable.



ELECTRIC AIRCRAFT

Global devices offer developed in-house by Expleo (Silver Atena)

The context

By answering the growing needs of urban mobility the sky more than roads will soon be the next place to move. But more than 20% of all carbon emissions are caused by transportation. It is now time to offer new solutions. In order to reduce noise pollution and the environment footprint while concurrently enabling economic and social opportunities that have never existed before, manufacturers started to develop electric flying devices.

The project

Silver Atena is supporting manufacturers of electric aircraft by providing solutions for a complete electronic environment beginning with power generation and distribution, battery management, computing platforms for flight control up to controllers for e-motor and actuators. In addition it can offer FADECs for innovative propulsion systems.

Expleo's expertise in action

- System design & architecture
- Functional safety
- Hardware / software engineering
- Manufacturing, test & verification
- Qualification & certification
- Production & series delivery

What's next?

Research on innovative and even more efficient motor designs together with sophisticated control units will lead to optimised drive trains for electric aircraft.



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NON CONFORMANCE MANAGEMENT

Service offer developed by Expleo

The context

During quality control, some parts may show non-conformance. It is then necessary to quickly assess the impact of this anomaly on the assembly of the mating parts. The non-conformance is a massive issue for aircraft manufacturers, that happens often on the same components. It is essential to optimize the management of concessions in order to be more efficient and encourage cost/time-savings.

The project

Expleo developed a solution to delegate the assessment of the conformity of a part and approve or clear the concession according to manufacturing standards. The use of non-conformance management process can lead to reduce the number of concession. Based on comparative analysis recorded in a database, the non-conformance management can clear concession that happened before and fasten the process.

Expleo's expertise in action

- Design & stress analysis
- Data analysis
- Non-conformance assessment

What's next

In order to complete the offer and optimize the process, non-conformance management will soon be able to add data science, machine learning and AI to its tools.



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